



MLDS CENTER

Maryland Longitudinal
Data System

Better Data • Informed Choices • Improved Results

The Effect of High School Career and Technical Education on Postsecondary Outcomes

B. Heath Witzen

MLDS Center & University of Maryland, College
Park

Presented at MLDS Center Research Series
February 1, 2018

Introduction

- Career and Technical Education (CTE) programs have increasing prominence in policy conversation
 - Desire to increase students' abilities to earn well-paying and stable employment
- Goal: Provide students with career-focused education that can directly lead to an employment or path of continuing education
- CTE as a way of increasing skills and providing avenues for better careers without the problem of “tracking” students inherent in past vocational education

Purpose of this work

- Look at long-term effects of CTE education on student outcomes
 - Enrollment in postsecondary institutions
 - Degrees earned
 - Wages and salaries
- Use a propensity score matching technique, that under a set of assumptions generates a *causal* effect of CTE program completion

Design of CTE Programs

- CTE Curriculum
 - Students complete a sequence of (typically) 4 courses to complete a CTE sequence
 - Typically begin with 1 course in sophomore year or 2 courses in junior year
 - Programs are organized into 10 “career clusters” which describe the type of program (ex. Transportation Technologies)
 - Programs must be designed such that a student is prepared for a postsecondary track or is prepared for an industry credential
- To finish high school students typically must satisfy the USM requirements, finish a CTE sequence, or both
- Classes are either taken at the student’s high school or a CTE Center located in their school district

Previous Evidence on CTE

- Mixed effects of CTE education on postsecondary enrollment and wages
- CTE completers are less likely to be enrolled, but much of this is attributed to differences in student characteristics
- CTE completers more likely to be employed
- The effects of CTE can vary dramatically by the type of program
- Specific sources of CTE program evaluation
 - US Ed, National Assessment of Career and Technical Education (2014)
 - Kreisman and Stange (2016)
 - IES Technical Working Group on Career and Technical Education Meeting (2017)

Data

- Focus on the cohort of high school graduates in the 2009-2010 academic year
 - Allows for 6 years of post high school outcomes
- High school completions:
 - Type of high school program completed (USM, CTE, both)
 - CIP code of CTE program completed matched to the program cluster
- Demographic information (race, gender, ethnicity)
- HSA Scores
- Free and reduced price meals eligibility
- Special education status
- Limit to high school graduates
- End with 40,020 students

Summary Statistics

Variable	No CTE	CTE Only	CTE and USM
% Male	46	59	48
% White	59	67	61
% Hispanic	7	4	6
% FARMS	20	31	23
% with HSA Algebra	15	49	14
Avg. HSA Algebra	416	416	418
% with HSA English	95	96	97
Avg. HSA English	427	402	419
% with HSA Biology	65	91	74
Avg. HSA Biology	431	413	428
N	30,152	4,798	5,070

Program Breakdown

Program (% Completing)	CTE Only	CTE and USM
Arts, Media, and Communication	3	5
Business, Management, and Finance	11	22
Career Research and Development	20	6
Construction and Development	15	7
Consumer Services, Hospitality, and Tourism	13	9
Environmental, Agricultural, and Natural Resources	4	3
Health and Biosciences	4	12
Human Resource Services	14	17
Information Technology	4	8
Manufacturing, Engineering, and Technology	3	7
Transportation Technologies	9	4

Raw Outcomes by Type of CTE Completion

Variable	No CTE	CTE Only	CTE and USM
% Initial 2-year Enrollment	27	28	36
% Initial 4-year Enrollment	48	7	37
% Associate's degree earned	10	7	15
% Bachelor's degree earned	44	5	34
Annual Wages 6 years later	\$13,856	\$15,152	\$17,513

Method: Propensity Score Matching

- Goal: generate a “causal” effect of CTE education
- Problem: other “confounding” variables exist that may be related to both CTE completion and postsecondary outcomes
 - This produces bias
- Propensity score matching
 - Using confounding variables that we are able to observe, match CTE completer students with non-completers of similar characteristics
 - Propensity score is the conditional probability of experiencing the treatment given individual’s values on confounders (Rosenbaum & Rubin, 1983).

Method: Propensity Score Matching

- A propensity score is an individual's probability of being “treated” (ex. Completing CTE)
- Use this score to find non-CTE completers that have a predicted probability of completing CTE programs that is very close to that of CTE completers

Matching Variables

- Race
- Gender
- Ethnicity (Hispanic/Not Hispanic)
- Special Education status
- FARMS
- HSA Scores (interacted with indicators for the scores being present)
 - Algebra
 - English
 - Biology
- Local Education Agency of student's high school

CTE and USM vs. USM Only

Examining the effect of CTE for only those who complete the USM requirements

Match Quality

	Standardized Mean Difference	Differences are expressed in a term called Cohen's d.
Male	0.010	
White	0	A reference point is 0.2 is considered a "large" difference
Hispanic	0.010	
FARMS	0	
% HSA Algebra	0.010	
HSA Algebra	0.030	
% HSA English	0.020	
HSA English	0.010	
% HSA Biology	0.020	
HSA Biology	0.020	

Enrollment Effects of CTE

	<i>Dependent variable:</i>			
	2yr-1	4yr-1	2yr-2	4yr-2
	(1)	(2)	(3)	(4)
CTE	0.035*** (0.009)	-0.049*** (0.009)	0.037*** (0.009)	-0.059*** (0.009)
Dep. mean	0.35	0.39	0.31	0.37
Observations	10,136	10,136	10,136	10,136
R ²	0.062	0.187	0.046	0.196

Note: *p<0.1; **p<0.05; ***p<0.01

2yr-1 := "Two-year enrollment, 1 year after high school graduation

Effects are in terms of probabilities

Enrollment Effects of CTE

	<i>Dependent variable:</i>			
	2yr-3	4yr-3	2yr-4	4yr-4
	(5)	(6)	(7)	(8)
CTE	0.026*** (0.008)	-0.063*** (0.009)	0.017** (0.007)	-0.057*** (0.009)
Dep. mean	0.23	0.39	0.15	0.42
Observations	10,136	10,136	10,136	10,136
R ²	0.031	0.201	0.029	0.195

Note:

*p<0.1; **p<0.05; ***p<0.01

Degree Effects of CTE

	<i>Dependent variable:</i>			
	Enr6	A.S.	B.A	Cert
	(1)	(2)	(3)	(4)
CTE	-0.002 (0.008)	0.032*** (0.007)	-0.037*** (0.008)	0.004 (0.003)
Observations	10,136	10,136	10,136	10,136
R ²	0.023	0.050	0.207	0.021

Note:

*p<0.1; **p<0.05; ***p<0.01

Effects of CTE on wages

Wages 6 years later: Wages in the year 6 years after high school graduation

Wages at first employment: Wages in the first year after your last enrollment

Dependent variable:

Wages 6 years later

Wages at first empl

(1)

(2)

CTE

3,058.789***
(355.400)

2,370.536***
(294.249)

Observations

10,136

10,136

R²

0.035

0.036

Note:

*p<0.1; **p<0.05; ***p<0.01

Degree Effects by Program Cluster

	<i>Dependent variable:</i>			
	Enr6	A.S.	B.A	Cert
	(1)	(2)	(3)	(4)
Arts, Media, and Communication	0.006 (0.025)	0.011 (0.021)	-0.038 (0.027)	0.011 (0.010)
Business Management and Finance	-0.007 (0.013)	0.015 (0.011)	0.025* (0.014)	0.006 (0.005)
Career Research and Development	-0.031 (0.024)	0.011 (0.021)	-0.131*** (0.026)	0.007 (0.010)
Construction and Development	-0.051** (0.022)	0.013 (0.018)	-0.079*** (0.023)	0.011 (0.009)
Consumer Services, Hospitality and Tourism	-0.040** (0.019)	0.075*** (0.016)	-0.077*** (0.021)	-0.004 (0.008)

Wages Effects by Program Cluster

Dependent variable:

Wages 6 years later	Wages at first empl.
(1)	(2)

Arts, Media, and Communication

−540

(1,132)

−500

(934)

Business Management and Finance

3,240***

(603)

2,940***

(500)

Career Research and Development

3,330***

(1,105)

2,280**

(915)

Construction and Development

4,620***

(982)

2,050**

(813)

Consumer Services, Hospitality and Tourism

1,390

(872)

460

(723)

Earnings Effects by Program Cluster

	<i>Dependent variable:</i>	
	Wages 6 years later	Wages at first empl.
	(1)	(2)
Environmental, Agricultural and Natural Resources	−570 (1,388)	−1,520 (1,150)
Health and Biosciences	3,430*** (798)	3,540*** (661)
Human Resource Services	3,680*** (677)	3,190*** (561)
Information Technology	2,700*** (969)	3,390*** (802)
Manufacturing, Engineering and Technology	2,280** (1,001)	2,480*** (829)
Transportation Technologies	8,883*** (1,285)	3,317*** (1,065)

Any CTE Completion vs. No CTE

- Examining the effect of any CTE completion versus those who do not
- Summary:
 - Generally larger negative effects on degree receipt (both types)
 - Increases in wages, but smaller than the CTE and USM group

Limitations

- Wages are limited to those working in MD and are not federal employees
 - Future work in this project is to use bounding techniques to correct if there is differential
- Matching produces a causal result if all possible confounding variables are included
 - If another variable that affects CTE completion and the dependent variable, there may be possible bias
- We are looking at early career wages. The way that wages evolve over a career could impact the effect of CTE on later career earnings
 - We need more years of data to begin addressing this

Conclusion

- Examined the effect of CTE program completion on postsecondary outcomes
- Find that programs generate some degree of substitution between four-year degrees and two-year degrees
 - This effect can vary greatly by the type of program (program cluster)
- Find that CTE programs generally result in higher annual earnings
 - This effect does not seem to vary as widely by the type of program

Future Research

- Use a similar technique to examine whether CTE has an effect on HS graduation
- Look at industry codes to see if employment is related to the CTE field of study
- Using another method to improve causal inference
 - Instrumental variables- distance to CTE Center or Technical High School
- Suggestions?